

# A High- $p_T$ Calorimeter Trigger for STAR

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The STAR Experiment at RHIC aims to study the properties of hot dense nuclear matter produced in high energy heavy ion collisions. In order to effectively study the production of high  $p_T$  particles via hard scattering and any modifications to the distributions due to parton energy loss in the nuclear medium, it is necessary to be able to trigger on events with high  $p_T$  particles.

The STAR EMC, which fully covers the barrel of the TPC, is finely segmented into 4800 towers in  $(\eta, \phi)$  which project back to the nominal interaction vertex at the center of the detector. The installation of the EMC is a multi-year project, with the first portion of the barrel ( $\sim 20\%$ ) installed and commissioned during the 2001 Au+Au program at RHIC.

The EMC provides fast triggering capabilities. The Level 0 EMC High Tower Trigger selects events in which at least one single EMC tower has a 6-bit ADC signal above a threshold which corresponds to  $E_T \geq 2$  GeV or  $E_T \geq 4$  GeV.

The trigger was commissioned and debugged during the Au+Au program with test data taken near the end of the run. Offline software was written to compare the 6-bit trigger signals with the full 10-bit information recorded by the DAQ system. This proved essential to the commissioning, as it was discovered that the trigger timing needed adjustment and the default high tower thresholds were found to be set too low. These issues were corrected and the trigger was used successfully during the proton run which completed at the end of January, 2002.

The offline software will also be used to determine the high tower trigger efficiency, which is needed to properly normalize the measured yields to absolute cross-sections.

Fig. 1 shows the  $p_T$  spectrum of charged particles measured in the TPC from pp collisions at  $\sqrt{s_{NN}}=200$  GeV for three different trigger sets. The solid black histogram is from the minimum bias trigger, while the dotted red and dashed blue histograms are for two different thresholds of EMC high tower

triggered events. A clear enhancement in the high  $p_T$  spectrum from the high tower trigger is evident.

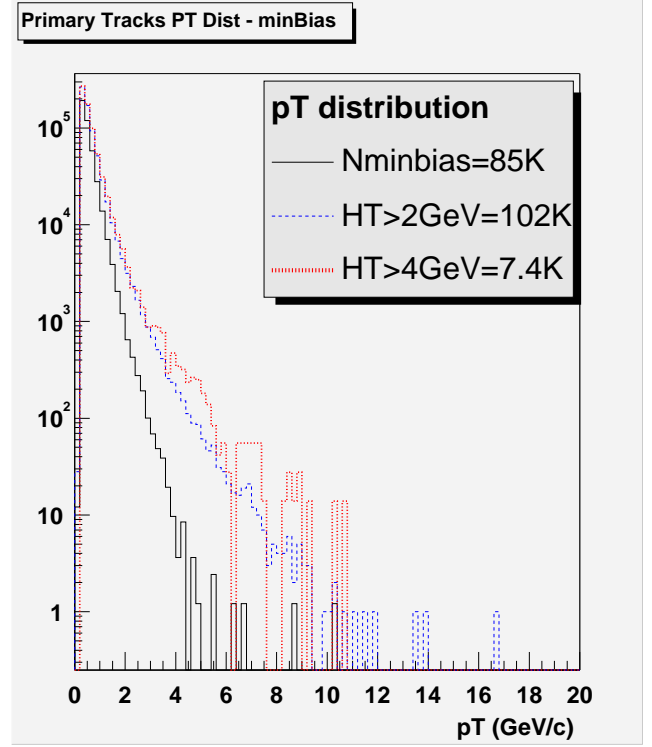


Figure 1:  $p_T$  distribution of charged particles for different triggered pp collisions[1].

## References

- [1] Plot provided by Mirko Planinic, Indiana University Cyclotron Facility.